DROPLET CLUSTER BEHAVIOR IN DENSE AND DILUTE REGIONS OF A SPRAY

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A review is presented of modeling work relevant to evaporation and combustion in liquid rocket engine chambers. It is proposed that, because of the complexity of the phenomena occurring in the combustion chambers, these should be first understood individually in an uncoupled manner and thus coupled together. Thus, two of these phenomena are discussed in detail: the multicomponent aspect and the supercritical aspect, both in the context of drop interactions.

I highlights of models describing evaporation, ignition and combustion of clusters of binary-fuel drops are discussed. Results from these models show that different parameters control evaporation, ignition and combustion of dense and dilute clusters of drops. The significance of these findings is addressed.

A model of subcritical and supercritical evaporation of drops in clusters is presented. The differences between this model and other models is pointed out. important aspects of supercritical thermodynamics are discussed. Numerical difficulties particular to this very realistic model are pointed out. It is also pointed out that drop interactions are expected to be important at higher air/fuel mass ratios in the supercritical regime than in the subcritical regime.

Strategies for using these models to construct a model of a liquid rocket combustion chamber are discussed.